CALIFORNIA DIVISION OF MINES AND GEOLOGY

FAULT EVALUATION REPORT FER-134

September 30, 1982

1. Name of fault

Dunnigan Hills fault.

2. Location of fault

Zamora, El Dorado Bend, and Woodland 7.5-minute quadrangles, Yolo County (figure 1).

3. Reason for evaluation

Part of 10-year fault evaluation program (Hart, 1980).

4. List of References

Brown, R.D., 1970, Faults that are historically active or that show evidence of geologically young surface displacement, San Francisco Bay region, a progress report: U.S. Geological Survey Miscellaneous Field Studies Map MF-331, scale 1:250,000.

Bryan, K., 1923, Geology and ground-water resources of Sacramento Valley, California: U.S. Geological Survey Water-Supply Paper 495, 285p.

Hart, E.W., 1980, Fault-rupture hazard zones in California: California Division of Mines and Geology Special Publication 42, 25p.

Helley, E.J. and Barker, J.A., 1979, Preliminary geologic deposits of the Dunnigan, Woodland, Lake Berryessa, and Guinda 15-minute qudrangles, California: U.S. Geological Survey Open-file Report 79-1606, scale 1:62,500.

Helley, E.J. and Herd, D.G., 1977, Map showing faults with Quaternary displacement, northeastern San Francisco Bay Region, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-881, scale 1:125,000.

Herd, D.G., (in press), Map of principal late-Quaternary faults, San Francisco Bay region, California: U.S. Geological Survey Miscellaneous Field Studies Map, scale 1:250,000 (fault traces compiled from 1:24,000 work maps).

Rofe', R., 1962, Dunnigan Hills gas field, California, in Bowen, O.E., Jr., (ed), Geologic guide to the gas and oil fields of northern California: California Division of Mines and Geology Bulletin 181, p. 119-132.

U.S. Department of Agriculture, 1964, Aerial photos ABB-3EE, 94-99, 25 to 27, 136 to 139, black and white, vertical, scale approximately 1:8,000.

Wagner, D.L., Jennings, C.W., Bedrossian, T.L., and Bortugno, E.J. 1981, Geologic map of the Sacramento quadrangle: California Division of Mines and Geology Regional Geologic Map Series, Map No. 1A, scale 1:250,000.

5. Review of available data, brief air photo interpretation.

The Dunnigan Hills is a broad, northwest trending, southeast plunging anticlinal structure located just west of Highway 5 (Rofe', 1962; figure 1). The eastern flank of the Dunnigan Hills is characterized by a linear escarpment that Bryan (1923) and Brown (1970) mapped as a probable young surface fault. Pliocene Tehama Formation crops out throughout most of the Dunnigan Hills and is mapped as offset by the Dunnigan Hills fault (Helley and Barker, 1979) (figure 2).

The sense and magnitude of offset along the Dunnigan Hills fault has not been documented, but is inferred to be predominantly vertical, northeast side up (Helley and Herd, 1977). This style of faulting is based on the linearity of the northeastern side of the Dunnigan Hills compared with the less-abrupt break with the valley floor on the southwest side of the hills (Helley and Herd, 1977). The northeast side of the Dunnigan Hills is about 50 meters higher than the valley floor, although it is not known how much of this elevation difference is due to folding and how much is due to faulting.

Bryan (1923) first recognized the possibility of a fault along the east flank of the Dunnigan Hills. He called it the Hungry Hallow fault and based its location on the linear escarpment. Bryan postulated about 400 feet of down to the east displacement at the north end of the fault and about 200 feet of displacement at the south end near Cache Creek.

Brown (1970) mapped a generally linear fault along the northeast side of the Dunnigan Hills, but the base map scale (1:250,000) is too small to evaluate in this FER. Helley and Herd (1977) map the Dunnigan Hills fault as probably Holocene active, based on the sharp escarpment and fresh linear features in deposits such as linear tonal contrasts, a bench, trench, and sag ponds (?) (figure 2). A later map by Helley and Barker (1979) depicts traces of the Dunnigan Hills fault identical to the traces of Helley and Herd (1977), but at a scale of 1:62,500 and with annotated fault traces in addition to detailed mapping of Cenozoic depostis (figure 2).

Photo lineaments mapped by Helley and Barker (1979) are difficult to verify based on very brief interpretation of 1964 U.S.D.A. air photos by this writer (figure 2). The northeast-facing escarpment of the Dunnigan Hills is generally not linear in detail and is dissected. Tonal lineaments in alluvium are relatively abundant east of the Dunnigan Hills and are primarily formed by old, abandoned stream channels. The three parallel tonal lineaments in section 35 just west of Highway 505 may be artificial (figure 2). There is no evidence of systematic offset of drainages, either in a lateral or vertical sense. Major drainages, such as Willow Spring Creek, Zamora Creek, Bretona Creek, and Oat Creek, have broad, alluviated valley floors that have been incised by the modern drainages. The magnitude of downcutting does not change across the mapped trace of the fault. Sharp, well-defined tonal lineaments were observed locally by this writer, but these features are not associated with geomorphic evidence that might indicate recent faulting (figure 2).

There are significant differences in fault traces mapped by Helley and Barker (1979) and Herd (in press) (figure 2). Herd (in press) maps a single, continuous, concealed fault along the base of the east side of the Dunnigan Hills, based primarily on the linear escarpment (figure 2). Various deposits mapped by Helley and Barker (1979), including the Pleistocene Red Bluff Formation, Riverbank Formation, and Modesto Formation, are not offset by the Dunnigan Hills fault of Herd (in press).

6. Conclusions

The Dunnigan Hills fault, a northwest-trending fault with inferred displacement predominantly vertical (down on the east), is located along the northeastern flank of a southeast plunging anticline. Helley and Barker (1979) observed geomorphic evidence permissive of Holocene faulting, principally tonal lineaments in alluvium and possible sag ponds, along a discontinuous northwest trend (figure 2). Many of these tonal lineaments are not well-defined, are bedding, or are probably artificial, based on very brief air photo interpretation by this writer (figure 2). There is no evidence of systematic offset of drainages that cross the mapped trace of the Dunnigan Hills fault (figure 2). Herd (in press) maps a concealed fault along the general trend of the fault mapped by Helley and Barker (1979) (figure 2), although Herd's traces only locally coincide with Helley and Barker's. If Herd's fault exists, it must be concealed by Pleistocene units, which implies that the fault has not been active since late-Pleistocene time.

7. Recommendations

Recommendations for zoning faults for special studies are based on the criteria of sufficiently active and well-defined.

Do not zone the Dunnigan Hills fault. This fault does not meet the criteria of sufficiently active and well-defined, based on very brief observations by this writer.

8. Report prepared by William A. Bryant, September 30, 1982.

William A. Bryant

I agree with recommendations. EWH 10/5/82